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**PROGRESS REPORT OPERABLE UNIT 5 -  
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Environmental Management Project

# Remedial Investigation/ Feasibility Study

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PROGRESS REPORT

OCTOBER 1993

## Operable Unit 5 ENVIRONMENTAL MEDIA

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### Introduction

The Remedial Investigation/Feasibility Study (RI/FS) is the blueprint for cleanup at the U.S. Department of Energy's Fernald Environmental Management Project. The nature and extent of contamination at the Fernald site and surrounding areas is being thoroughly investigated so that appropriate remedial actions can be formulated and implemented.

The Fernald site has been divided into five sections, known as Operable Units, for environmental investigation and cleanup. The Operable Units were defined based on their location or the potential for similar technologies to be used in the ultimate cleanup.

During the course of the RI/FS effort, certain conditions are occasionally identified which call for more immediate action. These actions are called "removal actions" and are initiated when there is a need to accelerate cleanup activities to address releases or potential releases of hazardous substances. Removal actions are coordinated with the U.S. EPA and the Ohio EPA.

Following is a progress report on Operable Unit 5 including its history, the current status of RI/FS activities, cleanup alternatives under consideration, and work being done to alleviate near-term concerns.

### Background

Operable Unit 5 encompasses the environmental media at the Fernald site and surrounding areas that could be impacted by the facility. While other Operable Units focus on specific waste facilities or defined areas, Operable Unit 5 is concerned with those environments that could be affected by the Fernald site. "Environmental media" includes the groundwater including perched water, surface water,

soils, sediments, vegetation and wildlife throughout the Fernald site and surrounding areas. The groundwater includes the Great Miami Buried Valley Aquifer, a source of water in the vicinity of the Fernald site. Surface waters include the Great Miami River, Paddy's Run, and the Fernald site's storm sewer outfall ditch. Sediments in Operable Unit 5 include solid materials carried in stormwater runoff or plant effluent discharges to surface waters or drainage ditches. Soils on and off the Fernald site boundaries also are being investigated for possible contamination due to past discharges or air emissions.

### RI/FS Activities

**Field Activities:** Operable Unit 5 recently completed additional field investigations to support identification of the nature and extent of chemical and radiological contamination in soil, sediments, surface water, groundwater and perched water. These investigations were needed to support development of the Operable Unit 5 Remedial Investigation (RI) report, and were described in seven separate Project Specific Plans (PSPs).

One PSP implemented DOE's strategy to sample a large majority of monitoring wells on Fernald property -- along with numerous monitoring wells off site -- all within several months during 1993. This "snapshot" of groundwater conditions will enable DOE to assess current contamination concentrations at the various well locations. The data acquired from this effort will supplement existing data and will be used in site characterization, groundwater modeling, and risk assessment for the RI Report.

Operable Unit 5 personnel developed another PSP to investigate the glacial overburden and

perched groundwater underlying the Fernald site. The glacial overburden is a deposit consisting primarily of clay, sandy clay, and silty clay beneath the Fernald site. Water does not readily flow through clay, and is sometimes held above the clay in silt, sand, or gravel as perched groundwater. Previous sampling has shown that some of the perched groundwater beneath the Fernald site is contaminated.

Because the clay acts as a barrier to water flow, portions of the glacial overburden help protect the Great Miami Aquifer from infiltration of contaminated perched groundwater and surface water. The field work for the glacial overburden PSP centered on specific hydraulic tests (pump tests, slug tests, and water-level monitoring). The data from the tests will be used to help scientists better understand the potential for the movement of water through the overburden material. In addition, the data will be used to refine groundwater modeling, which, in turn, will improve the scientists' ability to make long-term predictions of how contaminants might move through these media.

## Modeling

Groundwater modeling is one of the few tools scientists have available to help them make long-term predictions of how contaminants could move through the soil and groundwater. The models are made up of mathematical formulas that use data collected during the RI/FS investigation to simulate current environmental conditions. By using models, scientists can project future contamination levels and their associated risks under different cleanup options for up to 1000 years. For example, the models can predict what groundwater quality will be in 500 years if contaminated soil is removed today, if the contaminated groundwater is pumped from the aquifer, or if cleanup actions are not taken. Then regulators and others can compare future risks associated with each remedial alternative to help them decide which remedial alternative to select.

The results of the modeling will be presented in the final Operable Unit 5 RI report, which will be submitted to the U.S. EPA and Ohio EPA in the spring of 1994 for review and comment.

## Reports

DOE submitted a draft report to U.S. EPA in May 1993 which characterizes background water quality for streams and groundwater in the vicinity of the Fernald site. After completing technical discussions with U.S. EPA, DOE agreed to compile and statistically evaluate existing data to determine the concentrations at which chemicals and metals (including uranium) occur naturally in groundwater and surface water near the Fernald site.

In June 1993, U.S. EPA conditionally approved the report, pending incorporation of their comments. This information will be used to support RI/FS documents and risk assessments for all five operable units.

DOE also submitted a draft report to U.S. EPA in August 1993 which evaluated possible impacts and associated risks to ecological receptors at Fernald and surrounding areas from years of production. To prepare this screening level ecological risk assessment, Operable Unit 5 personnel established study areas based on habitat and the size of the home-range for the ecological receptors, evaluated the major fate and transport processes at Fernald, and looked at the various ways that ecological receptors come into contact with contaminants.

After preparing the screening level ecological risk assessment, Operable Unit 5 personnel concluded that -- with few exceptions -- contaminants associated with Fernald were not adversely impacting ecological receptors in the study areas. Additional data collected since the screening study will be reviewed to verify these conclusions. The sitewide ecological risk assessment -- which is part of the Operable Unit 5 RI Report -- will present the detailed evaluation of ecological risk.

**Treatability Studies:** DOE and FERMCO Operable Unit 5 personnel have initiated a treatability study to determine if soil washing is a viable alternative for cleaning the contaminated soil/sediments at Fernald. Treatability studies are prepared during the initial RI/FS stages to support the applicability of innovative technologies for environmental restoration. Operable Unit 5 has constructed a pilot-scale soil washing unit at Fernald for this purpose. Soil washing operations began in June 1993. Data generated from this study will be evaluated and incorporated

into the Operable Unit 5 Feasibility Study report. This information also will be shared with all DOE facilities through the Fernald Uranium Soils Integrated Demonstration program.

## Removal Actions

**Contaminated Water Beneath FEMP Buildings (Removal Action No. 1):** This removal action was initiated to minimize the potential for uranium-contaminated groundwater to infiltrate the underlying aquifer from perched water zones located beneath some former production buildings. "Perched" water is present in isolated pockets within the layers of clay-rich glacial soils that exist above the Great Miami Buried Valley Aquifer in the Fernald area.

Perched water zones beneath Plants 6, 2/3, 8, and 9, are of concern due to the discovery of significant concentrations of uranium and volatile organic compounds. To minimize the potential for the movement of contaminated water in these zones to the underlying aquifer, a series of wells were installed to extract the perched groundwater for treatment.

A treatment system at Plant 8 uses activated carbon filters to remove volatile organic compounds from the extracted water. The water is then processed through the Fernald site's existing water treatment system for the removal of uranium and is eventually discharged to the Great Miami River. Treatment of perched groundwater will continue in this manner until the Advanced Waste Water Treatment system is operational in early 1995.

Pumping from all extraction wells and treatment at Plant 8 has been halted since the inadvertent transfer of uranyl nitrate hexahydrate (UNH) material to Plant 8 in April 1993. This resulted in shut-down of all Plant 8 operations pending corrective actions. Plant 8 wastewater treatment operations were restarted in September 1993. The Plant 8 VOC treatment system is expected to be restarted in November 1993.

**South Groundwater Contamination Plume (Removal Action No. 3):** The purpose of this removal action is to protect public health by limiting access to the use of uranium-contaminated groundwater in an area south of the Fernald site. This removal action is broken into five parts.

Part 1 provides an alternate water source to an

industry affected by the contamination plume. This portion of the project involved the installation of production wells outside the plume area and a water supply system to the affected industry. Part 1 construction was completed in December 1992. Ohio EPA approval to begin operation was received in March 1993. A 60-day operating acceptance period was successfully completed May 24, 1993.

Another affected industry, which uses a minimal amount of groundwater for non-drinking purposes, will be provided with an alternate water supply by being connected to the proposed public water system.

Part 2 involves the installation of a groundwater recovery well system to extract and pump groundwater from the South Plume through a force main pipeline back to the Fernald site for monitoring and subsequent discharge to the Great Miami River. The groundwater recovery well system became operational August 27, 1993.

The South Plume pump test began May 25, 1993, and was completed June 1, 1993. The pump test was essential in meeting the August 28, 1993, due date for operation of the hydraulic barrier pump and discharge system under the terms of DOE's 1991 Amended Consent Agreement with U.S. EPA. The pump test data was used to set the screened intervals of the recovery wells. It also was essential for setting initial pumping rates for the recovery system, and for recalibrating the groundwater flow model.

A new effluent outfall pipeline was installed under Part 2. Use of the Fernald site's original effluent outfall pipeline to the Great Miami River was discontinued as of May 1, 1993, due to its age and limited capacity to handle future flow. The new outfall pipeline parallels the original outfall pipeline to the Great Miami River.

Part 2 work also includes increasing the pump-out capacity at the Stormwater Retention Basin to reduce the potential for future overflow of the basin. This work was completed in July 1993.

Construction of an aeration facility is essentially complete under Part 2, to address the low dissolved oxygen content of the extracted groundwater.

Part 3 involves construction of an Interim Advanced Wastewater Treatment (IAWWT) system. The IAWWT system removes uranium from site wastewater streams and, by doing so, reduces the amount of uranium discharged to the Great Miami

River. This treatment capacity will compensate for the additional planned discharges of uranium from the South Plume and other removal actions to the river.

Two trailer-mounted IAWWT facilities and associated support systems comprise the IAWWT unit located near the Stormwater Retention Basin. This system became operational in July 1992. A second IAWWT unit is located at the Fernald site's existing Bionitrification Effluent Treatment building. Alterations were made to that unit and it was returned to operational status (before the pumping of contaminated groundwater was initiated under Part 2), so that the negotiated reduction of uranium discharges to Great Miami River will be met.

Part 4 of the removal action involves groundwater monitoring and institutional controls to prevent the use of contaminated groundwater. This activity is being implemented through the Fernald site's existing Groundwater Monitoring Program, including more frequent monitoring of private wells located near areas of known contamination.

Part 5 involves additional groundwater investigations in the vicinity of the South Plume to identify the location and extent of any remaining contamination attributable to Fernald in the groundwater south (downgradient) of the recovery wells installed under Part 2. Because the U.S. EPA has issued a proposed limit of 20 parts per billion (ppb) for uranium in drinking water, the Part 5 investigation is attempting to identify the location of the leading edge of the plume exceeding the 20 ppb level.

The initial phase of Hydropunching®, and sampling of existing monitoring wells in the area downstream of the well field, are complete. Only one hydropunch sample exceeded 20 ppb.

The second phase is also complete, which involved installation of a vertical set of monitoring wells staggered from the surface down to bedrock, located near the center of the extraction well field. These wells and peizometers were used to identify groundwater elevation changes during the South Plume pump test.

The third phase was completed in August 1993. This work involved installation of two rows of monitoring wells and associated Hydropunching® upgradient and downgradient of the well field. This effort is known as the 12 Well Program, and is being used to identify groundwater contamination and

measure water levels. Sampling investigations associated with the third phase have identified two peizometers where uranium exceeded 20 ppb. These wells also will be used to support evaluations of the effectiveness of the South Plume Removal Action.

**Collect Uncontrolled Production Area Runoff - Northeast (Removal Action No. 16):** The scope of this removal action is to collect stormwater runoff from perimeter areas of the 136-acre former production area which are not presently draining into the Stormwater Retention Basin. Construction is in progress. This project was completed August 20, 1993.

**Advanced Wastewater Treatment System: Phases I and II** of the Advanced Wastewater Treatment System (AWWT) project have been initiated. The objective is to provide advanced treatment of stormwater runoff (Phase I) and wastewaters generated as a result of conducting cleanup activities (Phase II) for removal of radionuclides prior to discharge from the Fernald site. System design work is complete. The prime construction contract has been awarded and the contractor mobilized in April 1993. Procurement of the AWWT's Ion Exchange System is also in progress. Construction activities in support of Phases I and II are scheduled to be completed in late 1994, with Phases I and II scheduled for operations to begin in early 1995.

Preliminary engineering in support of contaminated groundwater treatment is in progress. These efforts will support the Operable Unit 5 Feasibility Study and detailed design efforts following the Operable Unit 5 Record of Decision.

**Supplemental Environmental Project:** DOE has agreed to conduct a Supplemental Environmental Project with the objective of reducing uranium discharges from the Fernald site to the Great Miami River. As part of this project, one additional Interim Advanced Wastewater Treatment unit will be installed to treat 200 gallons of water per minute (gpm). This system is scheduled to be operational by March 1994, and it is expected to further reduce uranium discharges to the river.

In addition, the lifespan of the existing IAWWT unit at the Stormwater Retention Basin will be extended, and this unit will be converted to treat additional South Plume water instead of stormwater.

The treatment capacity of this unit, scheduled to go on line in January 1995, will be increased from 300 gpm to 400 gpm. This effort also is expected to further reduce uranium discharges.

The Supplemental Environmental Project also will utilize Phase I of the AWWT for South Plume water treatment when no stormwater is available, which amounts to approximately six months per year. This will provide an additional 350 gallons per minute of treatment capacity, and further reduce uranium discharges to the river.

DOE also will eliminate treatment of low-uranium streams from Phase II of the AWWT project. This includes the sewage treatment plant and the "clean side" general sump. The additional capacity will be used to treat additional South Plume water at a rate of 200 gallons per minute, which will further reduce uranium discharges to the river beginning in March 1995.

The original Engineering Evaluation/Cost Analysis (EE/CA) for the South Plume Removal Action stated the DOE would provide a hydraulic barrier utilizing recovery wells to prevent further migration of the contamination plume. In addition, DOE stated that the water from these recovery wells would be of such low uranium concentrations (fewer than 30 parts of uranium per billion parts of water) that it would not be economically feasible to treat this water.

DOE suggested to the public and to the U.S. and Ohio EPAs that the groundwater would be pumped and discharged directly to the Great Miami River without treatment. As a result of a public comment period and U.S./Ohio EPA comments on the EE/CA, DOE agreed that the additional pounds of uranium that would be entering the river was unacceptable. DOE then developed the "equivalent mass concept" with support from the U.S. EPA and Ohio EPA. This concept calculated the amount of uranium discharges from Fernald in recent years, and the amount of additional uranium the South Plume and other Removal Actions would contribute to that total.

Two IAWWT units were strategically positioned at locations where effluent containing elevated levels of uranium was present (the Stormwater Retention Basin and the Bionitrification facility). DOE proposed to U.S. EPA that treatment of these streams containing elevated levels of uranium would compensate for uranium discharges to the river from the South Plume and other Removal Actions.

The objective of the "equivalent mass concept" was to ensure that uranium discharges would not increase to the river due to the Removal Actions and, in fact, that they would continue to be decreased progressively in future years.

In summary, with the implementation of the Supplemental Environmental Project and South Plume Removal Action, uranium discharges to the Great Miami River will be reduced by all reasonable measures prior to final groundwater remediation.

### Cleanup Alternatives

While a range of alternatives are under consideration for dealing with contaminated groundwater, the most viable alternative currently appears to be pumping it out of the ground and returning it to the Fernald site for possible treatment and discharge to the Great Miami River.

Cleanup alternatives for soils and sediments include removing and treating them for disposal either at the Fernald site or an off-site disposal facility, or treating contaminated soils and sediments in place and isolating the materials from the environment with a protective covering system.

More information about Operable Unit 5 is available in the Public Environmental Information Center (PEIC), where Fernald Project cleanup documents are kept in the Administrative Record. The PEIC is located in the JAMTEK building, 10845 Hamilton-Cleves Highway, Harrison, Ohio, 45030. The telephone number is (513) 738-0164.